REMARKS

Applicant appreciates the Examiner's thorough examination of the subject application and requests reconsideration of the subject application based on the foregoing amendments and the following remarks.

Claims 1-54 are pending in the subject application. Claims 1-7 and 9-54 stand rejected under 35 U.S.C. §103. Claim 8 was objected to as depending from a rejected base claim, however, the Examiner indicated that the claim would be allowable if appropriately re-written in independent form.

35 U.S.C. §103 REJECTIONS

Claims 1-7 and 9-54 stand rejected under 35 U.S.C. §103 as being unpatentable over Foo et al. [USP 5,017,872; "Foo"] in view of Fujita et al. [USP 6,169,401; "Fujita"]. Applicant respectfully traverses as discussed below. Although the within claims are being rejected over one combination of references, the above-referenced Office Action articulates different bases for rejection of claims or groups of claims. As such, the following addresses the specific grounds articulated in the Office Action for the below identified grouping of claims.

CLAIMS 1, 45, & 46

As grounds for the rejection, the above-referenced Office Action provides that Foo discloses a device for detecting near field electromagnetic signals, comprising a strip array antenna, wherein the strip array antenna includes a plurality of conductors arranged so a long axis of each is in

parallel and spaced from each other. It also is admitted that Foo, however, does not disclose having the length of each conductor set so as to substantially reduce coupling of a signal in one of the plurality of conductors to an adjacent conductor independent of the spacing between adjacent conductors. The Office Action further asserts that Fujita discloses that the length of each conductor is set so as to substantially reduce coupling of a signal in one of the plurality of conductors to an adjacent conductor independent of the spacing between adjacent conductors. It thus is concluded in the Office Action that it would have been obvious to one of ordinary skill in that art to modify the antenna disclosed in Foo for the purpose of manipulating the current distribution in accordance with the region from which the highest signal uniformity is desired as shown by Fujita.

Applicant respectfully traverses and disagrees with the characterization of what is allegedly disclosed or taught in either of the two cited references. Applicant also asserts that the suggested modification to the coil disclosed in Foo would completely destroy the intended purposes, function and operation of the coil disclosed therein.

Applicant claims, claim 1, a device for detecting near field electromagnetic signals, comprising a strip array antenna. A strip array antenna according to the present invention includes a plurality of conductors arranged so a long axis of each is in parallel and spaced from each other. Also, a length of each conductor is set so as to substantially reduce coupling of a signal in one of the plurality of conductors to an adjacent conductor(s) independent of the spacing between adjacent conductors.

As is described and discussed in the subject application, and as illustrated in a number of the figures thereof, the strip array antenna is comprised of a plurality of conductors. Further, it is

described and illustrated therein that each conductor of the strip array antenna of the present invention forms an independent detector element of the strip array antenna so that each conductor can independently detect electromagnetic signals. As is more clearly shown in FIG. 9A for example, each of the conductors 140 comprising the strip array antenna 100 is coupled to an independent channel of an NMR/ MRI system.

In contrast to the present invention, Foo does not describe a strip array antenna as that term is used and described in the subject application. Instead Foo describes a cylindrical MRI coil, that is referred to therein and by those skilled in the art as a "birdcage" coil. In Foo, it is clearly shown and described that all conducting strips that extend axially in the cylindrical coil are connected to each other by end rings (see 19, 22 in figure 1 thereof). Because all of the conductor elements are electrically connected to each other, the structure formed is clearly a coil, as is described in Foo, not an array of conductors that comprise independent detector elements as in the present invention.

Notwithstanding the foregoing, it also should be noted that Foo does not disclose a cylindrical coil that is used for detection of signals. In Foo the cylindrical coil appears to be used for NMR excitation. As described in Foo the cylindrical coil is driven by a single RF signal source so as to generate a single "RF magnetic field ... known as a circularly polarized RF excitation field" (e.g., see col. 6, line 62 through col. 7, line 2 thereof).

Moreover, Foo does not describe anywhere or make reference anywhere to a strip array antenna made up of a plurality of conductors, where each conductor forms an independent detector element. Also, the text cited to in the Office Action as allegedly describing a strip array antenna does not refer to a strip array antenna or the construction of an antenna array as is described in the

subject application and claimed by Applicants. Instead, Foo clearly describes that the structure of the so-called "high-pass coil" 10 is made up of a plurality of linear conductive elements 20 that extend in an axial direction and circular conductive elements 21,22 that are positioned at each end of the coil and are connected to the respective ends of the linear conductors (see col. 6, lines 50-59). Moreover, Foo specifically describes the so-formed structure as a "birdcage" coil. Thus, the rejection appears to based on using only ***a portion*** of the structure described in Foo that makes up only a part of the cylindrical coil described in Foo. This is apparently done without giving any consideration to the fact that such a truncation of or modification to the structure comprising the described cylindrical coil would destroy the design and functionality of the cylindrical coil that is described in Foo.

If one were, nonetheless to take the coil described in Foo ("Foo coil") and remove all the connecting end sections in order to make an array of separate conductors analogous to the strip array antenna of the present invention, then such an array would not be tuned, and would therefore be dysfunctional, if not useless as a detector coil, because in Foo the end conductors constitute essential tuning elements. Furthermore, a stated purpose of the Foo coil is: "*When driven by an RF signal source the coil 10 produces an RF magnetic field which fills the cylindrical space occupied by the subject...*" (see col. 6 lines 61-65, thereof). Thus if the end connections were removed to create a cylindrical structure with a series of parallel longitudinal untuned conductors, as distinct from the structure of the strip array antenna of claim 1, exactly how would the singular "*an RF signal source*" be connected to this device? It could not be connected to all of them without shorting or connecting all the ends together as before. If it were

connected to any single one of the parallel conducting strips, it certainly would not produce *"an RF magnetic field which fills the cylindrical space occupied by the subject"* and in particular a field with the uniformity portrayed in figures 2-5 thereof because with only one strip activated, the field would be highly localized to that strip even if it were tuned, as for example, shown in Lee (Magn Reson Med 2001; 45: 673-683, Fig 10). With it untuned, a useful field will not obtain but whatever there is will still be highly localized. Finally one could ask, given that the said *"a RF signal source"* will have 2 terminals (eg, +ve and –ve), and if one connection is made to the strip, where will the 2nd terminal be connected? Another strip? The other end of the strip? There are a number of possibilities, with no teaching or suggestion of any given or particular possibility provided in Foo. Thus, breaking up the Foo coil to produce an array of parallel (untuned) strips would thwart the whole purpose, design, and teaching of Foo, and therefore is not obvious to one killed in the art.

As to the secondary reference, Fujita, this reference also does not disclose nor describe a strip array antenna as is taught and claimed by Applicant. In Fujita, all conducting strips in the coil described therein are directly interconnected to each other by means of conducting end legs as is clearly shown in figures 2-4 thereof (see also claim 1 thereof). As indicated in the discussion above regarding Foo, the conductors of the present invention form independent detector elements and thus are not directly electrically coupled to one-to-another by a conductor so as to be capable of forming independent channels.

The individual detectors of Fujita also form loops that have extended sensitivity in the plane of the conductors, by virtue of 4 sides of each loop being fully engaged in the excitation

and/or detection process. This is evident in figure 2 of Fujita, which shows the current paths (dashed) in each loop. In contrast, because the strip array antenna of the present invention is comprised so that each conductor or conducting strip forms a detector or detector element, each conductor does not have extended sensitivity in the plane of the coil. Thus, the performance characteristics of the individual detector elements or conductors of the strip array antenna of the present invention are entirely different from that of the so-called surface coil described Fujita because of their intrinsically different geometries.

The coil described in Fujita also does describe or disclose adjusting the conducting strip length as a mechanism to tune the structure to resonate at the NMR frequency. Instead, Fujita tunes the coil by the use of capacitors, the use of which is described in claims 1, 2, 10 and 15 thereof for example. While Fujita does envisage multi-channel detection, it is clear that the number of channels is limited to 2 per array section as shown in D, D' in figure 4 thereof. This is so because if any additional receivers are connected across other capacitive elements in the array sections, they will not be independent due to the fact that the loops share common conductor paths/modes. Therefore no further multi-channel benefit can be achieved by this design. In contrast, the strip array antenna of the present invention is not so limited and thus can be adapted so as to provide a plurality of conductors or channels as well as being adaptable to provide a massively parallel multi-channel conductor strip array antenna simply by adding additional conducting strips. This can be accomplished in the present invention because each conducting strip is independent of the next and each conductor has a length set such that a signal in one conductor is not coupled to an adjacent conductor(s).

Applicant also respectfully disagrees with the assertion that one skilled in the art would have been motivated to make the suggested combination so as to modify the coil structure described in Foo to obtain the highest uniformity of Fujita. Foo's cylindrical coil is much more uniform, than Fujita's coil because of the cylindrical nature of the coil which provides signal detection from all sides, compared to Fujita which detects only from a single side. The uniformity of Foo is illustrated in Figs 2-5 of '0872 wherein the contour values vary one from another by not much more than 10%. The Foo cylindrical coil, which encloses the study object, is far more uniform than Fujita's flat coil which is only placed next to the subject.

Also, because Foo's coil is cylindrical the 1st and last straight sections parallel to the cylindrical axis are one and the same and the entire structure resonates when tuned such that the distance around the perimeter is one wavelength. Under this condition, there is no phase discontinuity for an EM wave travelling around the cylinder perimeter, as there would be, for example, if the EM wave were 1.5 times the distance around the perimeter. Such a wave would cancel as the ending portion of the wave has a different phase from the starting portion that falls on the same rungs. This condition is a property of the fact that the cylinder is continuous with all the rungs connected. On the other hand Fujita's coil is not continuous: the 1st and last "rungs" are not connected to each other but are at opposite ends of the coil. Therefore, the coil in Fujita is not tuned like the Foo coil so that the EM wavelength from, for example, edge 30 and 38 of figure 2, is one wavelength, because 30 and 38 are not adjacent to each other or are not the same rung. Fujita does not say anything about this in the text, rather, the individual current loops are tuned in the fashion as described therein.

Because both the Fujita and Foo coils are based on loop structures with all the conducting elements connected, even if Foo were modified to produce a coil incorporating Fujita, such a new structure must also be based on loop structures with the elements interconnected. Therefore, such a structure would NOT be in the form of the strip array antenna as claimed by Applicant and described in the subject application. Since neither the Fujita coil nor the Foo coil have each and every rung or longitudinal conducting elements separated one from another and not electrically connected, then any Foo coil modified according to Fujita, would also not include longitudinal conducting elements separated one from another, and therefore such a structure would NOT and could NOT form a structure of a strip array antenna as is claimed by Applicant and described in the subject application.

Applicant also respectfully submits that Fujita nowhere sets forth the limitation, as is set forth in claim 1, that the length a length of each conductor is set so as to substantially reduce coupling of a signal in one of the plurality of conductors to an adjacent conductor(s) independent of the spacing between adjacent conductors. As admitted in the Office Action, Foo nowhere describes such a feature. This is not surprising because in Foo the coil is tuned by means of the circular end conducting elements and the capacitors located in the end conducting elements (see col. 6, lines 55-65 thereof). Thus, not only can it not be said that Foo does not disclose this feature, it also is clear that Foo teaches away from this by teaching another tuning technique.

As to the suggestion that Fujita teaches such a limitation, Applicant respectfully disagrees. Nowhere in Fujita is it stated, suggested or described that the length of the conductor strips is determined or established so as to substantially reduce coupling of a signal in one of the

plurality of conductors to an adjacent conductor(s) independent of the spacing between adjacent conductors. Rather the language in Fujita from that referred to in the Office Action provides in pertinent part; "Those skilled in the art will appreciate that the desired imaging region will determine the spacing and/or lengths used" (see col. 4, line 67-col. 5, line l). As is known to those skilled in the art, such language is merely stating that the length is related to or depends on the *size* of the region of the sample. In other words, the length of the Fujita coil can be optimized for various anatomies and organs of interest. This, however, is necessarily different from relating or setting the length of the conductor so as to substantially reduce coupling of a signal in one of the plurality of conductors to an adjacent conductor(s) independent of the spacing between adjacent conductors. In this regard, it should be remembered, and as described in the subject application, the term "coupling" in connection with surface coils refers to the coupling of an MR signal in one coil or to an adjacent coil(s), such that the signal being outputted by the adjacent coil is a combination of the MR signal detected by the adjacent coil and the coupled MR signal. It also is clear that Fujita also nowhere refers to setting the length of the coil or conductive elements thereof so as to substantially reduce such signal coupling between adjacent conductors.

In sum, Foo and Fujita, alone or in combination do **not** describe, teach or suggest the strip array antenna as set forth in claim 1. Also, Foo and Fujita, alone or in combination do **not** teach, suggest or offer any motivation for modifying the "birdcage" coil disclosed in Foo so as to yield the strip array antenna as set forth in claim 1. In particular, Foo and Fujita, alone or in combination do **not** describe, teach or suggest the specific limitation as set forth in claim 1 that the length of each conductor is set so as to substantially reduce coupling of a signal in one of the

of plurality of conductors to an adjacent conductor(s) independent of the spacing between adjacent conductors. Moreover, modifying the "birdcage" coil as disclosed in Foo so as to yield the strip array antenna as set forth in claim 1 necessarily requires that the intended purpose, function, operation and arrangement of such a birdcage coil be destroyed. Consequently, it is clear that any such modification to Foo, would constitute a hindsight re-construction in view of the teachings and disclosures of the subject application.

Applicant respectfully submits that the foregoing remarks distinguishing claim 1 from the cited combination of references also applies to distinguish the method for detecting near field electromagnetic signals of claims 45 and 46.

It is respectfully submitted that claims 1, 45 and 46 are patentable over the cited reference(s) for the foregoing reasons.

CLAIMS 2, 31 and 47

As grounds for the rejection, the above-referenced Office Action provides that Fujita discloses that the length of each conductor is set so as to the equal to about $n\lambda/4$, where n is an integer ≥ 1 and λ is the wavelength of the signal to be detected (e.g., the wavelength corresponding to the NMR resonance frequency for the nuclei). Applicant respectfully traverses as well as disagrees with this characterization of the asserted teachings of the cited reference.

Claims 2, 31 and 47 depend respectively from independent claims 1, 30 and 46, which claims are considered to be allowable as indicated herein. As such, each of claims 2, 31 and 47 are considered to be allowable at least because of the dependency from an independent base claim that

is believed to be allowable. As to the further limitations of these claims, Applicant offers the following observations regarding the cited prior art.

The language cited in Fujita nowhere expressly provides that the length of each conductor is set so as to the equal to about $n\lambda/4$, where n is an integer ≥ 1 and λ is the wavelength of the signal to be detected (e.g., the wavelength corresponding to the NMR resonance frequency for the nuclei). This is not surprising as the teachings referred to in Fujita merely provides in pertinent part; "Those skilled in the art will appreciate that the desired imaging region will determine the spacing and/or lengths used" (see col. 4, line 67-col. 5, line 1). As is known to those skilled in the art, such language is merely stating that the length is related to or depends on the ***size*** of the region of the sample. This, however, is necessarily different from relating or setting the length of the conductor so as to substantially reduce coupling of a signal in one of the plurality of conductors to an adjacent conductor(s) independent of the spacing between adjacent conductors by setting the length of each conductor so as to the equal to about $n\lambda/4$, where n is an integer ≥ 1 and λ is the wavelength of the signal to be detected (e.g., the wavelength corresponding to the NMR resonance frequency for the nuclei).

It is respectfully submitted that claims 2, 31 and 47 are patentable over the cited reference(s) for the foregoing reasons.

CLAIMS 3-4, 21-22, & 34-35

As grounds for the rejection, the above-referenced Office Action provides that Foo discloses, with reference to figure 1 thereof, a number of parallel conductors comprising the strip

array antenna is one of 4 or more conductors, 16 or more conductors, or 32 or more conductors or in the range of one of the ranges of from about 4 to about 16 conductors, from about 4 to about 32 conductors or from about 16 to about 32 conductors. Applicant respectfully traverses.

Claims 3-4, 21-22 and 34-35 ultimately depend respectively from independent claims 1, 20 and 30, which claims are considered to be allowable as indicated herein. As such, each of claims 3-4, 21-22 and 34-35 are considered to be allowable at least because of the dependency from an independent base claim that is believed to be allowable. As to the further limitations of these claims, Applicant offers the following observations regarding the cited prior art.

As indicated in the discussion above regarding claim 1, the strip array antenna of the present invention is adaptable to a massively parallel multi-channel conductor strip array antenna simply by adding additional conducting strips. This can be accomplished in the present invention because each conducting strip is independent of the next and each conductor has a length set such that a signal in one conductor is not coupled to an adjacent conductor(s). This is nowhere suggested, taught or described in Foo. The general fact that many electrical devices include sections of parallel conductors for many different purposes, does not in of itself mean that any new device which happens to contain parallel conductors is obvious to one skilled in the art just because the another electrical device includes a section of parallel conductors, particularly when such another electrical device would be rendered inoperable if the teachings of the present invention were applied thereto.

It is respectfully submitted that claims 3-4, 21-22, and 34-35 are patentable over the cited reference(s) for the foregoing reasons.

CLAIMS 5-7, 19, 23 & 54

As grounds for the rejection of claims 5, 19 and 54, the above-referenced Office Action provides that Foo discloses, with reference to figure 1 thereof, an encapsulation member as set forth in claims 5, 19 and 54. As to the grounds for the rejection of claim 6, the above-referenced Office Action provides that Foo discloses, with reference to col. 3, lines 20-32, that the substrate and overlay are made of a material having a dielectric constant so that the wavelength of the electromagnetic wave on the each conductor is reduced so as to be in a desired range. As to the grounds for the rejection of claims 7 and 23, the above-referenced Office Action provides that Foo discloses, with reference to col. 4, lines 29-30, a material having a dielectric constant in the claimed range. Applicant respectfully traverses.

Claims 5-7, 19, 23 and 54 ultimately depend respectively from independent claims 1, 20 and 45, which claims are considered to be allowable as indicated herein. As such, each of claims 5-7, 19, 23 and 54 are considered to be allowable at least because of the dependency from an independent base claim that is believed to be allowable. As to the further limitations of these claims, Applicant offers the following observations regarding the cited prior art.

Foo does not disclose a ground plane. Instead Foo describes a cylindrical *"surrounding shield"* (col 3, line 24, 27; col 6 lines 52, 55; col 7 line 5, 48; col 8 line 37) avoiding the term "ground" throughout. Foo's shield is not connected to anything, as shown in figures 1, 6 thereof and no connection is disclosed in the text of the patent.

To teach how the birdcage coil is connected to an external source, Foo refers to Edelstein's US patent 4,680,548 (see col 6, line 66 of Foo). Referring therefore to the ("birdcage") coil described in Edelstein, the Edelstein coil has no shield nor "ground plane". Therefore it is not possible to connect the shield of the Edelstein coil to ground via an input connection because the shield does not exist. In fact, the input connections of the Edelstein coil are made each side of the tuning elements (e.g., 66 and 72 of Fig 3A thereof). Because Foo refers to Edelstein in the context of connections, the necessary and only conclusion that can be drawn is that the connection of Foo's coil is, as shown by Edelstein, across one of the tuning elements (23 etc in Fig 1 of Foo). Therefore, any ground connection made to the Foo coil that is formed by means of one side of the input connection being grounded is a ground made to the connecting end sections, and NOT to the shield. Therefore the shield of Foo is not a ground plane because: (a) the term "ground" is avoided by Foo throughout; and (b) Foo's shield is not connected to ground either directly or via some external input/output connection. In addition, because the shield is not connected to ground, the existence of any currents on the strip conductors will by virtue of Maxwell's Equations, induce image currents in the shield. Therefore the shield will not be at uniform ground, in point of fact.

Foo also does not refer to a substrate or an overlay. Figure 1 has only an annular space 13 between the coil 10 and shield 11 (see also col. 7 lines 3-5). Any overlay and/or other substrate thus can have no functional value for figure 1. The annular space 13 is filled with a dielectric material chosen so as to match the dielectric of the sample and to thereby optimize the uniformity of the field in objects placed inside the coil (see col. 8 lines 42-47, see also claim 1). Thus, Foo's

dielectric is chosen based on properties of the sample. Further it is chosen based on properties that will optimize the uniformity of the field.

The strip array antennas of the present invention does not have a dielectric chosen to match the sample dielectric properties. Each detector in the strip array antenna of the present invention does not intrinsically provide a uniform field (e.g., see Magn Reson Med 2001; 45: 673-683, Fig 10) compared to the original Edelstein coil, so it is not possible to improve the inhomogeneity by adjusting the dielectric in the manner described by Foo. In addition, Foo's dielectric is not an intrinsic part of the coil resonant structure used in conjunction with the strip length to tune individual strip detectors as is the case of the strip array antenna of the present invention. Foo's coil is tuned with the end capacitors (see col. 6 lines 59-61).

Figure 6 of Foo does, however, provide *"fiber glass forms 27 and 28"* to support the cylindrical shield on the outside and the cylindrically disposed conducting elements (see col. 8, lines 10-24). Unlike the dielectric material occupying the annular space 13, these *"forms"* are not referred to as dielectrics anywhere in Foo, nor is any function taught that requires them to posses a dielectric property as an intrinsic functional property of the Foo coil. Thus, unlike the strip array antenna of the present invention, Foo does not provide a dielectric overlay. If the rigid *"form"* does have dielectric properties these are certainly not matched to that of the filler material infused into the space 13 (col 8, lines 12-24). This again is contrary to disclosure of the present invention where the materials have the same dielectric propoerties.

Applicant also would note that the words "substrate", "overlay", "wavelength" and "desired range" do not appear anywhere in Foo. The text cited in connection with the rejection

of claim 6 refers to "variations in RF field strength" and the range as set forth in claims 7 and 23 does not appear anywhere in Foo.

It also should be noted that the above-referenced Office Action appears to be referring to element 11 in figure 1 both as disclosing a ground plane according to the present invention and a guard mechanism according to the present invention. As such, the within rejection is fatal as it is incumbent upon the Examiner to identify in the grounds of rejection features of the prior art that are considered to be equivalent to elements of the claimed invention. In the present case, however, the same feature in Foo is being utilized to allegedly teach or disclose two distinct and separate elements of the present invention.

It is respectfully submitted that claims 5-7, 19, 23 and 54 are patentable over the cited reference(s) for the foregoing reasons.

CLAIMS 9-11, 24-25, 36-37 & 48-50

As grounds for the rejection of claims 9 and 48, the above-referenced Office Action provides that Foo discloses, with reference to col. 5 lines 14-25 thereof, that each of the conductors is terminated in a manner so that the electromagnetic wave on each of the conductors is one of a standing wave or a traveling wave. As to the grounds for the rejection of claims 10, 24, 36 and 49, the above-referenced Office Action provides that Foo discloses, with reference to col. 3, lines 3-18, a termination mechanism operably connected to one end of each conductor and configured so as to terminate each of said one end as one of a short or an open. As to the grounds for the rejection of

claims 11, 25, 37 and 50, the above-referenced Office Action provides although Foo does not disclose that one end of each conductor is terminated with a resistive match and wherein N is an even integer, it would have been obvious to one of skill in the art to modify to include such a termination and to set the length of each conductor so n is an even integer. Applicant respectfully traverses.

Claims 9-11, 24-25, 36-37 and 48-50 ultimately depend respectively from independent claims 1, 20, 30 and 45, which claims are considered to be allowable as indicated herein. As such, each of claims 9-11, 24-25, 36-37 and 48-50 are considered to be allowable at least because of the dependency from an independent base claim that is believed to be allowable. As to the further limitations of these claims, Applicant offers the following observations regarding the cited prior art.

It first should be recognized that it is practically speaking impossible for Foo to disclose, teach or suggest different termination schemes for the axially extending linear conductive elements 20, which linear conductive elements are asserted in the Office Action as being equivalent to the conductors of the claimed invention. As indicated above, the birdcage coil disclosed in Foo consists of a plurality of linear conductive elements 20 that extend in an axial direction and circular conductive elements 21,22 that are positioned at each end of the coil and are *electrically connected to the respective ends of the linear conductors* (see col. 6, lines 50-59). Thus, to contend that Foo teaches terminating the linear conductive elements 20 in any of the manners set forth in the above-identified claims is nowhere supported by the disclosures in Foo as that all that Foo teaches is that the linear conductive elements are electrically connected to the circular conductive elements. As also provided above in the discussion regarding claims 5-7, 19, 23 and 54, Foo refers to Edelstein in

the context of connections which also teaches connecting across one of the tuning elements that are located in a circular end conductive element.

Applicant respectfully submits that the language being referred to in Foo relative to the standing or traveling wave does not involve termination of the conductors, a termination mechanism, nor establishing a standing wave on a so-terminated conductor. The standing wave referred to in col. 5, line 19 of Foo is a wave between the annular dielectric and the sample or torso with matched dielectric placed in the middle of the cylindrical coil (see col. 3, line 9). The waves described in the present invention Lee are propagating along the length of the conducting strip or conductor: that is, perpendicular to Foo's waves, which is as different as one can get.

There also is not specific reference, disclosure, teaching or suggestion anywhere in Foo that the one end of each linear strips is terminated as one of an open, a short or a resistive match. There also is not suggestion or disclosure that such a modification to the coil in Foo would be reasonably successful. In addition, there is no suggestion anywhere why one skilled in the art would have terminated one end thereof with a resistive match as well as setting the length of each conductor so n of $n\lambda/4$ is an even integer.

It is respectfully submitted that claims 9-11, 24-25, 36-37 and 48-50 are patentable over the cited reference(s) for the foregoing reasons.

CLAIMS 12-16, 26 & 51

As grounds for the rejection of claims 12, 26 and 51, the above-referenced Office Action provides that Foo discloses, with reference to element #11 of figure 1 thereof, a signal guard

mechanism being arranged so that the guard mechanism isolates at least a portion of the strip array antenna from external EMF interference. As grounds for the rejection of claim 13, the above-referenced Office Action provides that Foo discloses, with reference to col. 7, lines 3-17 thereof, a guard mechanism that includes a plurality of guard elements, where a guard element is disposed in proximity to each end of the strip array antenna to isolate at ends of the strip array antenna. As grounds for the rejection of claim 14, the above-referenced Office Action provides that Foo discloses, with reference to col. 7, lines 3-17 thereof, a guard mechanism that includes a plurality of guard elements, where a guard element is disposed along and in proximity to each side of the strip array antenna to isolate at least sides of the strip array antenna. As grounds for the rejection of claims 15, the above-referenced Office Action provides that Foo discloses, with reference to col. 7, lines 3-17 thereof, a guard mechanism that is disposed in proximity to each end of the strip array antenna and along and in proximity to each side of the strip array antenna to isolate ends and sides of the strip array antenna. As grounds for the rejection of claims 16, the above-referenced Office Action provides that Foo discloses, with reference to element #11 of figure 1 thereof, that the guard mechanism is electrically grounded. Applicant respectfully traverses.

Claims 12-16, 26 and 51 ultimately depend respectively from independent claims 1, 20 and 45, which claims are considered to be allowable as indicated herein. As such, each of claims 12-16, 26 and 51 are considered to be allowable at least because of the dependency from an independent base claim that is believed to be allowable. As to the further limitations of these claims, Applicant offers the following observations regarding the cited prior art.

It first should be noted that the above-referenced Office Action appears to be referring to element 11 in figure 1 as disclosing a ground plane according to the present invention and a guard mechanism according to the present invention. As such, the within rejection is fatal as it is incumbent upon the Examiner to identify in the grounds of rejection features of the prior art that are considered to be equivalent to elements of the claimed invention. In the present case, however, the same feature in Foo is being utilized to allegedly teach or disclose two distinct and separate elements of the present invention.

As is set forth in the subject application and in the claims, the guard mechanism is provided to isolate a least a portion of the strip array antenna from external EMF interference. This is nowhere described or discussed in connection with Foo.

As to the assertion that the guard mechanism can be comprised of a plurality of guard elements, this also is not found in Foo nor is such an assertion supported by the disclosure in Foo. In Foo the shield 11 is described as a "solid metal shield" (see col. 6, lines 50-52) thus it cannot consist of guard elements that are disposed along an in proximity to a designated region or area of the strip array antenna because it could not be a unitary element as is described in Foo. The reference to the discussion in column 7 also is misplaced as that discussion has nothing to do with the constitution of the shield 11 but rather the arrangement of various elements making up the coil and how the body or subject under study 12 is located in the cylindrical cavity defined by the body 12.

As to the assertion that the metal shield 11 is connected to ground, Applicant would note that Foo nowhere provides or illustrates that the metal shield is at ground. Applicant also refers to

the discussion above as to claims 5-7, 19, 23 and 54 that also discusses why the metal shield also cannot be at ground as well as not comprising a ground plane according to the present invention.

It is respectfully submitted that claims 12-16, 26 and 51 are patentable over the cited reference(s) for the foregoing reasons.

CLAIMS 17-18, 28-29, 38-39 & 53

As grounds for the rejection, the above-referenced Office Action provides that Foo discloses the claimed invention except for the strip array antenna in which a spacing (s) between adjacent conductors and a height (h) of the encapsulation member is set so a ratio s/h satisifies the relationship $s/h \geq 2.5$ or $s/h \geq$ about 3. Applicant respectfully traverses.

Claims 17-18, 28-29, 38-39 and 53 ultimately depend respectively from independent claims 1, 20, 30 and 45, which claims are considered to be allowable as indicated herein. As such, each of claims 17-18, 28-29, 38-39 and 53 are considered to be allowable at least because of the dependency from an independent base claim that is believed to be allowable. As to the further limitations of these claims, Applicant offers the following observations regarding the cited prior art.

As admitted in the above-referenced Office Action, Foo does not anywhere define, describe, disclose, teach or suggest a ratio between the spacing of conductors and the height of the encapsulation member. Applicant also respectfully submits that this also is not a meaningful or essential parameter in the Foo coil design.

The subject application teaches that the parameter of the ratio s/h has special value for the strip array antenna according to the present invention in minimizing the EM coupling between

adjacent and other parallel conductors which in the present invention function as independent, non-interconnected detectors in the array. Foo does not recognize this ratio because there are no independent detector elements (i.e., the Foo coil is connected to a single source; see col. 6 line 62) with all the conducting sections directly connected (see col. 6, lines 55-62). Because all of the elements are so connected there can be no EM decoupling of the individual sections, the sections being directly coupled as opposed to that of the present invention where they are not. Because of this direct connection of the Foo elements, the ratio s/h cannot affect the coupling and has no value or meaning for the Foo structure. Moreover, the Foo coil absolutely depends on the coupling between all conducting sections in order to produce the uniform fields that are being claimed for it (see col. 8 lines 56-46; claim 1). Further, the Foo coil is tuned as a single integral structure, not as an array of separate tuned elements.

Thus, Foo does not and cannot disclose, teach, suggest, recognize or infer the ratio s/h which has special significance for minimizing coupling of the separate elements in the strip array antenna of the present invention. Even if the ratio could some-how be invoked after reading Foo, it would have no meaning in the context of Foo because the Foo coil is a single integrated inter-connected structure for which coupling is essential to its function. Thus, the suggested modification as a mechanism for further de-coupling of adjacent conductors is without merit and contrary to the teachings in Foo. Consequently, Foo also teaches away from the suggested modification.

As to the assertion in the Office Action that Fujita discloses the requisite teachings/ disclosure; Applicant respectfully disagrees. Fujita does not disclose specific dimensions for each

conductor in the portion of Fujita referred to in the Office Action (col. 4, line 57-col. 5, line 9). All that Fujita says is: *"..those skilled in the art will appreciate that the desired imaging region will determine the spacing and/or lengths used"*. This contains no specific recipe for conductor dimensions. As also indicated herein, all that Fujita is teaching is that the dimensions of length and spacing depend on the size of the external imaging region/sample. If the dimensions are determined on the basis of the size of the external imaging region as taught by Fujita, they CANNOT be determined on the basis of ratios of component sizes that are intrinsic to the coil/array itself. Again, as distinct from the subject application, the conductor lengths according to the teachings of Fujita are not tuned based an EM wavelength within the array structure, but rather are adjusted more-or-less arbitrarily based on the sample size. Thus a condition for s/h as taught in the subject application and claimed by Applicant cannot be deduced, forseen, taught or suggested based on that disclosed or taught in Fujita.

In addition, Fujita does NOT anywhere disclose or recognize the parameter s/h. The dimensions Fujita refers to are the "*spacing and/length*". Fujita does not refer to the height of the conductor above the ground plane, that is, the parameter *h* taught in the subject application because Fujita's coil has no ground plane or even a shield. Therefore Fujita CANNOT disclose, foresee, teach or suggest the existence of a ratio s/h because h does not exist in Fujita. It is not even possible to deduce a ratio s/h from the disclosures and teachings of Fujita.

As indicated above, the subject application teaches that the parameter of the ratio s/h has special value for the strip array antenna in minimizing the EM coupling between adjacent and other parallel conductors which in the present invention function as independent, non-

interconnected detectors in the array. Fujita does not, and cannot, recognize, teach or suggest such a ratio because there are no independent detector elements as all the conducting sections in Fujita are directly connected (see figures 2, 3 thereof). Because all of the elements are connected there can be no EM decoupling of the individual sections, and therefore the ratio s/h cannot affect the coupling nor have importance for the Fujita structure.

In sum, neither Foo nor Fujita disclose or recognize the parameter s/h, because a decoupling criteria based on s or h for conducting sections has no relevance for the coils disclosed and described in Foo and Fujita where all the conductors are directly interconnected. Also, the dimensions of both the Foo and Fujita coil structures are taught as being set based on properties of the sample being imaged and not on parameters intrinsic to the coil/array itself as is taught and claimed in the present invention. Further it necessarily follows that because s/h cannot even be defined for the Fujita structure, it CANNOT be concluded that Fujita provides any teaches or suggests of this feature of the claimed invention.

It is respectfully submitted that claims 17-18, 28-29, 38-39 and 53 are patentable over the cited reference(s) for the foregoing reasons.

CLAIMS 20, 30, 40 & 42

As grounds for the rejection, the above-referenced Office Action provides that reference should be made to the rejection of claims 1, 2, 5, 6 and 9. Applicant respectfully traverses.

Applicant respectfully submits that the foregoing remarks separately distinguishing each of claims 1, 2, 5, 6 and 9 from the cited combination of references also each apply to distinguish

the device for detecting near field electromagnetic signals of claim 20, the near field signal detection apparatus of claim 30, the MRI excitation and detection apparatus of claim 40 and the MR imaging system of claim 42.

As to claims 40 and 42, because all of the conductors in the Foo coil are interconnected and because the entire structure operates as a single resonating coil, Foo has no requirement for a plurality of detectors or multiple detectors. In particular, conducting sections of the Foo coil are not separable and are not separately connected to separate receiver channels. Therefore there is nothing in Foo that would provide any reason to add additional receiver channels because there is nothing in the Foo coil to connect them to. As such, Foo cannot expressly or inherently disclose the MRI excitation and detection apparatus of claim 40 and the MR imaging system of claim 42. See also the discussion herein regarding claims 31 and 33 as to further details as to why Foo cannot disclose the system having Y receivers operable coupled to the X conductors, where X and Y are both greater than or equal to 2.

It is respectfully submitted that claims 20, 30, 40 and 42 are patentable over the cited reference(s) for the foregoing reasons.

CLAIM 27

As grounds for the rejection, the above-referenced Office Action provides that reference should be made to the rejection of claims 15 and 16. Applicant respectfully traverses.

Applicant respectfully submits that the foregoing remarks separately distinguishing each of claims 15 and 16 from the cited combination of references also apply to distinguish the device for detecting near field electromagnetic signals of claim 27.

It is respectfully submitted that claim 27 is patentable over the cited reference(s) for the foregoing reasons.

CLAIMS 31 & 33

Claims 31 and 33 stand rejected for the reasons provide on pages 5-6 of the above-referenced Office Action. Applicant respectfully traverses.

Claims 31 and 33 ultimately depend respectively from independent claim 30, which claim is considered to be allowable as indicated herein. As such, each of claims 31 and 33 are considered to be allowable at least because of the dependency from an independent base claim that is believed to be allowable. As to the further limitations of these claims, Applicant offers the following observations regarding the cited prior art.

Because all of the conductors in the Foo coil are interconnected and because the entire structure operates as a single resonating coil, Foo has no requirement for a plurality of detectors nor multiple detectors. In particular, conducting sections of the Foo coil are not separable and are not separately connected to separate receiver channels. Therefore there is nothing in Foo that would provide any reason to add additional receiver channels because there is nothing in the Foo coil to connect them to.

In Foo the birdcage coil is connected to "*an RF signal source*" (singular), for excitation (col 6, line 62; col 7, line 2). As such, if the Foo coil is used only for excitation, this is certainly different from the strip array antenna of the present invention which is particularly suited for use only as a detector. However, if the Foo coil is used for both excitation and reception, then both the transmitter and receiver lines must be connected to the Foo coil at the same time. The only alternative would be to provide a mechanical switch, which is certainly NOT disclosed in Foo, and would be undesirable because of the relatively long switching time compared with the micro-second time scale of NMR experiments. Therefore, in the case where the Foo coil is used for both excitation and detection, the fact that both transmitter and receiver leads are directly connected to the coil, means that a different method of decoupling must be implemented than for the case where the strip array antenna is only used for detection. In particular, when using a coil for both transmit and receive, the decoupling mechanism must be placed in the connecting lines to stop current passage directly between the transmitter and receiver. In the case of a receive-only detector, the concern is that the transmit field will induce currents in the separate receive detector, which, by Lenz's Law, will oppose the transmit and thereby inhibit excitation. The induced fields may also be conveyed to the receiver and potentially damage it. In this case, the induced fields must be stopped in the detector. This is not the case for the single coil excite detect mode because there is only one coil, and when excitation stops, so do the induced currents. Thus, the requirement for decoupling the Foo coil which is certainly used for excitation as disclosed, and potentially used for reception as well, is fundamentally different from that of the strip array antenna of the present invention.

Also, Foo does not describe or disclose anywhere details of an MRI system, nor an MRI receiver, nor multiple MRI receivers, nor switches to turn on or off any conductors. Therefore nothing can be deduced about the nature of the MRI receivers or decoupling of conductors can be deduced, inferred or be considered obvious based on Foo.

As to the assertion that X=Y is disclosed in Foo, Applicant respectfully submits that this is not shown or disclosed anywhere in Foo. In addition, and as noted above, the fundamental difference between the construction of the birdcage coil disclosed in Foo and the strip array antenna taught of the present invention, necessarily means that the number of conductors of the birdcage coil cannot equal the number of receivers being connected to the coil. Consequently, such a teaching cannot be even inferred.

It is respectfully submitted that claims 31 and 33 are patentable over the cited reference(s) for the foregoing reasons.

CLAIMS 41, 43 & 44

Claims 41 43 and 44 stand rejected for the reasons provide on pages 6-7 of the above-referenced Office Action. Applicant respectfully traverses.

Claims 41 43 and 44 ultimately depend from one of independent claims 40 or 42, which claims are considered to be allowable as indicated herein. As such, each of claims 41, 43 and 44 are considered to be allowable at least because of the dependency from an independent base claim that is believed to be allowable.

It is respectfully submitted that claims 41, 43 and 44 are patentable over the cited reference(s) for the foregoing reasons.

CLAIM 52

As grounds for the rejection, the above-referenced Office Action provides that reference should be made to the rejection of claims 5 and 17. Applicant respectfully traverses.

Applicant respectfully submits that the foregoing remarks separately distinguishing each of claims 5 and 17 from the cited combination of references also apply to distinguish the method of claim 52.

It is respectfully submitted that claim 52 is patentable over the cited reference(s) for the foregoing reasons.

The following additional remarks shall apply to each of the above.

The Federal Circuit has indicated in connection with 35 U.S.C. §102 that in deciding the issue of anticipation, the trier of fact must identify the elements of the claims, determine their meaning in light of the specification and prosecution history, and identify *corresponding elements* disclosed in the allegedly anticipating reference (emphasis added, citations in support omitted). *Lindemann Maschinenfabrik GMBM v. American Hoist and Derrick Company et al.*, 730 F. 2d 1452, 221 USPQ 481,485 (Fed. Cir. 1984). Notwithstanding that the instant rejection is under 35 U.S.C. §103, in the present case the Examiner has not shown that the birdcage coils or surface coils of the admitted prior art corresponds, as that term is used above by the Federal Circuit, in any

fashion to the strip array antenna and the constituents thereof in their entire claimed form as set forth in any of the independent claims of the present invention.

As provided in MPEP 2143.01, obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re Fine*, 837 F. 2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F. 2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). As provided above, the references cited, alone or in combination, include no such teaching, suggestion or motivation.

Furthermore, and as provided in MPEP 2143.02, a prior art reference can be combined or modified to reject claims as obvious as long as there is a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 19866). Additionally, it also has been held that if the proposed modification or combination would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. Further, and as provided in MPEP-2143, the teaching or suggestion to make the claimed combination and the reasonable suggestion of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). As can be seen from the forgoing discussion regarding the disclosures of the cited references, there is no reasonable expectation of success provided in the reference. Also, it is clear from the foregoing discussion that the modification suggested by the Examiner would change the principle of operation of the device disclosed in Foo.

As stated by the Board Of Patent Appeals and Interferences; "...Before obviousness may be established, the Examiner must show that there is either a suggestion in the art to produce the claimed invention or a compelling motivation based on sound scientific principles." *Ex Parte Kranz*, 19 U.S.P.Q. 2d 1216, 1218 (BPAI 1990) (emphasis added). The Federal Circuit also has indicated that a prior art reference that gives only general guidance and is not all that specific as to particular forms of a claimed invention and how to achieve it, may make a certain approach obvious to try, but does not make the invention obvious. *Ex Parte Obukowicz*, 27 USPQ2d 1063, citing *In re O'Farrell*, 853 F.2d 894, 7 USPQ2d 1673,1681 (Fed. Cir. 1988).

As the Federal circuit has stated, "[t]he mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." *In re Fritch*, 972 F.2d 1260,1266, 23 USPQ2d 1780, 1783-84 (Fed. Cir. 1992). Obviousness may not be established using hindsight or in view of the teachings or suggestions of the inventor. *Para-Ordance Mfg. v. SGS Importers Int'l, Inc.*, 73 F.2d 1085, 1087, 37 USPQ2d 1237, 1239 (Fed. Cir. 1995).

It is respectfully submitted that for the foregoing reasons, claims 1-7 and 9-54 are patentable over the cited reference(s) and thus satisfy the requirements of 35 U.S.C. §103. As such, these claims are allowable.

CLAIM 8

In the above-referenced Office Action, claim 8 was objected to as being dependent upon a rejected base claim. It also was provided in the above-referenced Office Action, however, that

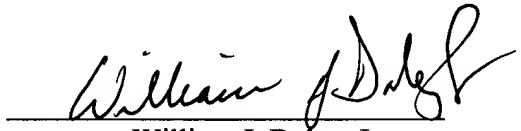
these claims would be allowable if rewritten in independent form to include all the limitations of the base claim and any intervening claim(s).

In as much as Applicant believes that the base claim is in allowable form, claim 8 was not re-written in independent form as suggested by the Examiner. Applicant, however, reserves the right to later amend the subject application so as to present this claim in independent form or to add an independent claim that contain the limitations of claim 8.

It is respectfully submitted that the subject application is in a condition for allowance. Early and favorable action is requested.

Applicant believes that additional fees are not required for consideration of the within Response. However, if for any reason a fee is required, a fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge Deposit Account No. **04-1105**.

Respectfully submitted,
EDWARDS & ANGELL, LLP

Date: May 20, 2003 By: 

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